ESA Section 7 Consultation Number F/NWR/2002/00650

National Marine Fisheries Service
Endangered Species Act Section 7 Consultation
and Magnuson-Stevens Act
Essential Fish Habitat Consultation

Agencies: The National Marine Fisheries Service (NMFS)
The U.S. Environmental Protection Agency (EPA)
The U.S. Army Corp of Engineers (COE)

Species/ESUs: Puget Sound (PS) chinook salmon *(Oncorhynchus tshawytscha),* Hood Canal summer-run (HCS) chum salmon *(O. keta)*

Activities Considered:

1. Issuance of Permit No. 1140 - modification 3 to the NMFS' Northwest Fisheries Science Center (NWFSC).
2. Issuance of Permit No. 1309 - modification 1 to the King County Department of Natural Resources (KCDNR).
3. Issuance of Permit No. 1381 to the City of Bellingham.
4. Issuance of Permit No. 1386 to the State of Washington Department of Ecology (DOE).

Consultation Conducted By: Protected Resources Division (PRD) of the Northwest Region, NMFS (Consultation Number F/NWR/2002/00650)

Approved By: ______________ for D. Robert Lohn, Regional Administrator

Date: **8/7/02** (**Expires on:** December 31, 2006)

This document is the NMFS' biological opinion for its review of proposed Endangered Species Act (ESA) section 10(a)(1)(A) permit applications described below, prepared in accordance with section 7 of the ESA of 1973, as amended (16 U.S.C. 1531 et seq.). This biological opinion is based on information provided in the applications for the proposed permits, comments from reviewers including NMFS' Northwest Fisheries Science Center, published and unpublished scientific information on the biology and ecology of threatened salmonids in the action area, and other sources of information. A complete administrative record of these consultations is on file with the NMFS' Northwest Region (NWR) in Portland, Oregon.

CONSULTATION HISTORY

NMFS proposes to issue two new permits and two modifications authorizing scientific research studies of threatened PS chinook salmon and threatened HCS chum salmon. NMFS grouped them in a single consultation pursuant to 50 CFR 402.14(c) because the proposed actions are similar in nature and will affect the same threatened species in the Puget Sound region. The consultation history for each of the permits is summarized below.

Proposed Amendments/Modifications to Existing Permits

Permit 1140 - NWFSC

On April 9, 2002 and April 23, 2002, NMFS' PRD received a request from the NWFSC's proposal to amend a permit that had been issued to John Stein. Both requests included a memorandum from the applicant with revisions and attachments.

Permit 1309 - KCDNR

On October 10, 2000, NMFS' PRD received a request from the KCDNR for a permit to be issued to James Schroeder. The request included a letter from the applicant and the permit application. NMFS issued the amended permit on February 22, 2002. On March 22, 2002 NMFS' PRD received a request from the KCDNR to modify the permit for additional take of ESA-listed species and to also identify Tom Nelson as the Permit Holder.

Proposed New Permits

Permit 1381 - City of Bellingham

On April 15, 2002, NMFS' PRD received a request from the City of Bellingham for a permit to be issued to Sheila Hardy. The request included a permit application submitted by the contractor, Anchor Environmental, L.L.C. on behalf of the city and a letter from the contractor agreeing to operate under the conditions of the permit.

Permit 1386 - DOE

On May 8, 2002, NMFS' PRD received a request from the DOE for a permit to be issued to Keith Seiders. The request included letter from the applicant and the permit application. On

May 10, NMFS' PRD requested additional information to complete the application. NMFS' PRD received the information from the DOE on May 16, 2002.

DESCRIPTION OF THE PROPOSED PERMITS

Common Elements Among the Proposed Actions

Permit modification actions considered in this Opinion would be in effect for the duration of that permit. The new permit actions considered in this Opinion are multi-year permits and would be in effect from two to five years. Based on prior experience, NMFS expects that the latter group of researchers will ask for an extension of the permit through (at least) 2006. Therefore, NMFS proposes to give the new permit discussed in this Opinion expiration dates of December 31, 2006.

When a permit holder does not expect to indirectly kill any juvenile PS chinook salmon and HCS chum salmon during the course of his or her work, NMFS sets an indirect mortality figure at two percent of expected take. The reason for this is that on occasion unforseen circumstances can arise and, based on years of research experience, NMFS has determined it is best in these instances to include modest overestimates of expected take. By doing this, NMFS gives researchers enough flexibility to make in-season research protocol adjustments in response to annual fluctuations in environmental conditions—such as water flows, larger than expected run sizes, etc.—without having to shut down the research because the expected take was exceeded. Also, high take estimates are useful when NMFS analyzes the effects of the actions, allowing accidents that could cause higher-than-expected takes to be included in the analysis.

Research permits list general and special conditions to be followed before, during, and after the research activities are conducted. These conditions are intended to: (a) manage the interaction between scientists and ESA-listed salmonids by requiring coordination of research activities among permit holders and between permit holders and NMFS; (b) require measures to minimize impacts on target species; (c) and report information to NMFS on the nature and impact of the permit holders on the species of concern. The following conditions are common to all of the permits. In all cases, the permit holder must:

1. Anesthetize each ESA-listed fish that is handled out-of-water. Anesthetized fish must be allowed to recover (e.g., in a recovery tank) before being released. Fish that are simply counted must remain in water and do not need to be anesthetized.

2. Handle each ESA-listed fish with extreme care and keep them in water to the maximum extent possible during sampling and processing procedures. The holding units must contain adequate amounts of well-circulated water. When using gear that captures a mix

of species, ESA-listed fish must be processed first to minimize the duration of handling stress. The transfer of ESA-listed fish must be conducted using a sanctuary net that holds water during transfer, whenever necessary to prevent the added stress of an out-of-water transfer.

3. Stop handling ESA-listed juvenile fish if the water temperature exceeds 70 degrees Fahrenheit at the capture site. Under these conditions, ESA-listed fish may only be identified and counted.

4. Use a sterilized needle for each individual injection when using a passive integrated transponder tag (PIT-tag) to mark ESA-listed fish. This is to minimize the transfer of pathogens between fish.

5. Notify NMFS in advance of any changes in sampling locations or research protocols and obtain approval before implementing those changes.

6. Not intentionally kill (or cause to be killed) any ESA-listed species the permit authorizes to be taken, unless the permit allows lethal take.

7. Exercise due caution during spawning ground surveys to avoid disturbing, disrupting, or harassing ESA-listed adult salmonids when they are spawning. Whenever possible, walking in the stream must be avoided, especially in areas where ESA-listed salmonids are likely to spawn.

8. Use visual observation protocols instead of intrusive sampling methods whenever possible. This is especially appropriate when merely ascertaining whether anadromous fish are present. Snorkeling and streamside surveys will replace electrofishing procedures whenever possible.

9. Comply with NMFS' backpack electrofishing guidelines when using backpack electroshocking equipment to collect ESA-listed fish.

10. Report to NMFS whenever the authorized level of take is exceeded, or if circumstances indicate that such an event is imminent. Notification should be made as soon as possible, but no later than two days after the authorized level of take is exceeded. Researchers must then submit a detailed written report. Pending review of these circumstances, NMFS may suspend research activities and/or reinitiate consultation to allow research activities to continue.

11. Submit to NMFS a post-season report summarizing the results of the research and the success of the research relative to its goals. The report must include a detailed description of activities, the total number of fish taken at each location, an estimate of the

number of ESA-listed fish taken at each location, the manner of take, and the dates/locations of take.

Additional permit conditions specific to each of the proposed research projects are included in the descriptions of the respective permits.

Some of the activities identified in the proposed permit actions will be funded by NMFS , the EPA, and the COE. Although these agencies are also responsible for complying with section 7 of the ESA because they are funding activities that may affect listed species, this consultation examines the activities they propose to fund and thus will fulfill their section 7 consultation requirement.

Finally, NMFS will monitor actual annual takes of ESA-listed fish species associated with scientific research activities, as provided to NMFS in annual reports or by other means, and shall adjust annual permitted take levels if they are deemed to be excessive or if cumulative take levels are determined to operate to the disadvantage of the ESA-listed species.

The Individual Permits

The following tables display the permits, overall amounts of take being requested in each permit application, the general actions with which that take would be associated, and general location of research activities. "Take" is defined in section 3 of the ESA; it means to harass, harm, pursue, hunt, shoot, wound, kill, trap,capture or collect or to attempt to engage in any such conduct. The table's purpose is to depict the total impact—strictly in terms of pure take numbers—that can be expected from the proposed research activities. Detailed, action-by-action breakdowns (i.e., how much take is associated with each activity in each permit) are found in the Determination of Effects section.

Table 1. Summary of the proposed Research and Enhancement Permits Considered in this Biological Opinion affecting PS chinook salmon.

*Direct mortality represents fish that are killed on purpose as part of the research; indirect mortality represents fish that are killed by accident when the research is conducted.

Permit No.	Take Requested (per year) Juvenile, Naturally-produced PS Chinook Salmon	Take Requested (per year) Juvenile, Artificially-propagated PS Chinook Salmon	Take Requested (per year) Adult PS Chinook Salmon	Proposed Types of Take	Location Washington State
1140	92 - Study 2	5 - Study 2		Capture/handle/stomach flush/release	Various nearshore estuarine sites in Central Puget Sound
	4 - Study 2	1 - Study 2		Indirect mortality*	
	98 - Study 3	5 - Study 3		Capture/handle/stomach flush/release	Commencement Bay
	129 - Study 3	7 - Study 3		Capture/handle/release	
	13 - Study 3	1 - Study 3		Indirect mortality	
	5,000 - Study 4			Capture/handle/mark/release	Skagit Estuary
	400 - Study 4			Indirect mortality	
1309		10 - Study 1		Direct mortality*	Various nearshore estuarine sites in Central Puget Sound
1381	20	40		Capture/handle/release	Whatcom Creek
	2	2		Indirect mortality	
1386	190	50	48	Capture/handle/release	Nooksack, Lower Skagit, Stillaguamish, Snohomish, lake Washington, Green/Duwamish, Puyallup, Puget Sound, and Hood Canal subbasins.
	4	1		Indirect mortality	

Table 2. Summary of the proposed Research and Enhancement Permits Considered in this Biological Opinion affecting HCS chum salmon.

*Direct mortality represents fish that are killed on purpose as part of the research; indirect mortality represents fish that are killed by accident when the research is conducted.

Permit No.	Take Requested (per year) Juvenile HCS chum Salmon	Take Requested (per year) Adult HCS chum Salmon	Proposed Types of Take	Location Washington State
1386	20	4	Capture/handle/release	Hood Canal and Puget Sound Subbasins
	1		Indirect mortality*	

Permit Modifications/Amendments

Permit 1140 - NWFSC

The NWFSC requested an amendment (modification 3) to its permit for increased annual takes of threatened juvenile, naturally-produced and artificially-propagated PS chinook salmon associated with study 2 and new studies 3 and 4 to be conducted in Commencement Bay, Washington. The NWFSC is currently authorized annual takes of threatened juvenile, naturally-produced and artificially-propagated PS chinook salmon. The NWFSC is currently authorized under permit 1140 to annually take: (a) threatened, naturally-produced and artificially-propagated, Snake River (SnR) spring/summer chinook salmon; (b) endangered, naturally-produced and artificially-propagated, Upper Columbia River (UCR) steelhead (*O. mykiss*); (c) threatened SnR fall chinook salmon, endangered UCR spring chinook salmon; (d) threatened, southern Oregon/northern California coast coho salmon (*O. kisutch*); and (e) endangered, SnR sockeye salmon (*O. nerka*).

Study 1. This study is designed to assess the relationship between environmental variables, selected anthropogenic stressors, and bacterial and parasitic pathogens on disease-induced mortality of juvenile salmon in selected coastal estuaries in Oregon and Washington. The study will provide a better understanding of how environmental factors influence disease transmission.

Study 2. This study evaluates the effects of shoreline development on nearshore fish and submerged aquatic plant assemblages. The NWFSC coordinates their work with the University of Washington who are studying the effects of shoreline development on supralittoral ecology. The study focuses on changes in diet and available prey resources for several fish species. The results of the pilot study will aid in designing statistically based studies to compare abundance, residence time, habitat use, diet, and behavior of juvenile salmon along the City of Seattle's shorelines. These investigations will help resource managers identify potential impacts of nearshore activities on ESA-listed fish, prioritize recovery actions, and identify approaches that provide maximum protection to listed fish habitat. The NWFSC proposes to harass (snorkel surveys and video cameras), capture, anesthetize, handle (examine stomach contents using non-lethal evacuation), and release PS chinook salmon.

Study 3. The NWFSC proposes to monitor seven sites (described in the permit application) in Commencement Bay for fish assemblage/habitat utilization, chemical contamination, and fish pathology information to evaluate the success of restoration activities. The NWFSC proposes to capture (using beach seines and trap/fyke nets), handle, and release PS chinook salmon.

Study 4. This study will investigate survival of chinook salmon in the Skagit River estuary. The study will focus on survival and residency of juvenile PS chinook salmon within estuaries. The study will help provide information on the ecological consequences of habitat restoration, degradation, and loss on stock population dynamics. Furthermore, the research will be designed to estimate fish handling mortality and delayed mortality due to marking. The NWFSC proposes to capture (using fyke nets), handle, mark (using an elastomer dye), and release PS chinook salmon.

Permit 1309 - KCDNR

The KCDNR requested an amendment (modification 1) to permit 1309 for a project modification and increased annual takes of threatened juvenile, artificially-propagated PS chinook salmon associated with study 1. The KCDNR is currently authorized annual takes of threatened juvenile, naturally-produced and artificially-propagated PS chinook salmon.

Study 1. The purpose of this study is to determine the presence of PS chinook salmon, improve understanding of juvenile salmon distribution, and to study their use of nearshore habitat in King County's lakes, streams, and marine nearshore habitat. The research will help determine the effectiveness of County programs at protecting, conserving, and restoring habitat for PS chinook salmon. Study 1 consists of four subtasks: (1) Agricultural watercourse monitoring, (2) the Cedar River restoration site monitoring, and (3) nearshore studies. The KCDNR is requesting authorization to capture ESA-listed fish using backpack electrofishing equipment. In addition the KCDNR proposes to examine the stomach contents (using non-lethal evacuation) of juvenile PS chinook salmon and intentionally sacrifice juvenile, artificially-propagated PS chinook salmon to collect coded wire tags from a subsample captured under their current take authorization. Samples will be transferred to the WDFW laboratory in Olympia, Washington for archival/research purposes. In addition to all other conditions, the following Special Condition will be included in Permit 1309:

- Whenever possible, ESA-listed juvenile fish indirect mortalities that occur during the conduct of research activities must be used in place of intentional lethal takes.

Study 2. This is a joint study with the University of Washington to obtain information about important salmonid habitats and uses in the Cedar River system and the effects of restoration. The research will help provide information to implement an effective countywide salmon recovery plan and to guide future habitat restoration efforts on the Cedar River, Washington. The research projects focus mainly on use of the Cedar River system by juvenile coho salmon and juvenile sockeye salmon. Chinook salmon inhabit the Cedar River but are not common in the study area.

Study 3. This study is designed to collect information about juvenile, naturally- produced and artificially-propagated PS chinook salmon survival and outmigration timing. In addition, the study will help refine sampling methods for application to future studies of salmonid survival in the Green/Duwamish watershed. This project will guide implementation of a later, more extensive study of the Lower Green River in addition to being a component of a larger effort to formulate a comprehensive salmonid recovery plan for the Green/Duwamish watershed.

Proposed New Permits

Permit 1381 - City of Bellingham

NMFS proposes to issue a permit to the City of Bellingham for annual takes of juvenile, naturally-produced and artificially-propagated PS chinook salmon associated with research to be conducted in the Whatcom Creek estuary. The purposes of the study is to determine a baseline usage of the project area by juvenile salmonids in order to monitor the effectiveness of integrated cleanup and habitat restoration plan implemented on the Holly Street Landfill. The City proposes to capture (using beach seines), anesthetize, handle, measure, and release juvenile, naturally-produced and artificially-propagated PS chinook salmon.

Permit 1386 - DOE

NMFS proposes to issue a permit to the DOE for annual takes of adult and juvenile, naturally-produced and artificially-propagated PS chinook salmon and HCS chum salmon during the course of research designed to evaluate level of toxic contaminants in surface waters, sediment, and aquatic animal tissues in several areas throughout Washington State. The study will benefit listed an non-listed species by identifying areas of high toxicity and using that information to clean up affected waters in accordance with the Clean Water Act. The DOE proposes to capture (using gill, fyke, and tangle nets and boat electrofishing), handle, and release adult and juvenile HCS chum salmon and naturally-produced and artificially-propagated PS chinook salmon.

The Action Area

<u>PS Chinook Salmon</u>

The action area for this consultation includes all marine, estuarine and river reaches accessible to listed chinook salmon in Puget Sound. Accessible reaches are those within the historical range of the ESU that can still be occupied by any life stage of salmon or steelhead. Puget Sound marine areas include South Sound, Hood Canal, and North Sound to the international boundary at the outer extent of the Strait of Georgia, Haro Strait, and the Strait of Juan De Fuca to a straight line extending north from the west end of Freshwater Bay, inclusive. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 13,761 square miles in Washington. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Clallam, Grays Harbor, Island, Jefferson, King, Kitsap, Lewis, Mason, Pierce, San Juan, Skagit, Snohomish, Thurston, and Whatcom.

HCS Chum Salmon

The action area for this consultation include all river reaches accessible to listed chum salmon draining into Hood Canal as well as Olympic Peninsula rivers between and including Hood Canal and Dungeness Bay, Washington. Also included are estuarine/marine areas of Hood Canal, Admiralty Inlet, and the Straits of Juan De Fuca to the international boundary and as far west as a straight line extending north from Dungeness Bay. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 1,753 square miles in Washington. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Clallam, Island, Jefferson, Kitsap, and Mason.

Critical habitat was designated for PS chinook salmon and HCS chum salmon in 2000 when NMFS published a final rule in the Federal Register (65 FR 7764). However, the critical habitat designation for these ESUs was vacated and remanded to NMFS for new rulemaking pursuant to a court order in April 2002. In lieu of a new rule designating critical habitat for PS chinook salmon and HCS chum salmon, this consultation will include an evaluation of the effects of the proposed actions on the species' habitat to determine whether those actions are likely to jeopardize the continued existence of the species.

STATUS OF THE SPECIES UNDER THE ENVIRONMENTAL BASELINE

To qualify for listing as a threatened species, PS chinook salmon and HCS chum salmon must constitute a "species" under the ESA. The ESA defines a "species" to include any "any subspecies of fish, wildlife, or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature." On November 20, 1991, NMFS published a policy (56 FR 58612) describing the agency's application of the ESA definition of "species" to Pacific salmonid species. This policy provides that a Pacific salmonid population will be considered distinct, and hence a species under the ESA, if it represents an ESU of the biological species. The population must satisfy two criteria to be considered an ESU: (1) It must be reproductively isolated from other conspecific population units, and (2) it must represent an important component in the evolutionary legacy of the biological species. The first criterion, reproductive isolation, need not be absolute, but must be strong enough to permit evolutionarily important differences to accrue in different population units. The second criterion would be met if the population contributed substantially to the ecological/genetic diversity of the species as a whole. Further guidance on the application of this policy is contained in "Pacific salmon

(*Oncorhynchus* spp.) and the Definition of Species under the ESA" (Waples, 1991) and a NOAA Technical Memorandum "Definition of 'Species' Under the Endangered Species Act: Application to Pacific Salmon" (NMFS F/NWC-1994).

The PS chinook and HCS chum salmon were listed as threatened under the ESA because NMFS determined that a number of factors—both environmental and demographic—had caused them to decline to the point where within the foreseeable future they were likely to be in danger of going extinct. These factors for decline affect their biological requirements at every stage of their lives and they arise from a number of different sources. This section of the Opinion explores those effects and defines the context within which they take place and provides information about their current status.

Status and Life History of ESUs Included in This Consultation

<u>PS chinook Salmon</u>

On March 24, 1999, NMFS listed PS chinook salmon, both naturally-produced and artificially propagated fish, as a threatened species (64 FR 14308). The ESU encompasses all naturally spawned populations of chinook salmon from rivers and streams flowing into Puget Sound including the Straits of Juan De Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington. NMFS also listed chinook salmon (and their progeny) from the following hatchery stocks because they were considered essential to the recovery of the ESU: Kendall Creek (spring run); North Fork Stillaguamish River (summer run); White River (spring run); Dungeness River (spring run); and Elwha River (fall run).

Chinook salmon in this ESU exhibit an "ocean type" life history (i.e., they emigrate to the ocean as subyearlings). While some spring- and summer-run populations in this ESU have a high proportion of yearling smolt emigrants, the proportion appears to fluctuate considerably from year to year. Populations in this ESU tend to mature at ages 3 and 4. Juvenile life stages (i.e., eggs, alevins, fry, and parr) inhabit freshwater/riverine areas through-out the range of the ESU. Parr usually undergo a smolt transformation as subyearlings in the spring at which time they migrate to the ocean. Subadults and adults forage in coastal and offshore waters of the North Pacific Ocean prior to returning to spawn in their natal streams. Adult spring-run chinook salmon in this ESU typically return to fresh water in April and May and spawn in August and September. In contrast, summer-run chinook salmon return in June and spawn in September, while summer/fall-run fish begin to return in August and spawn from late September through January. Hatchery chinook salmon are also distributed within the range of this ESU, and as noted above under "Status of PS chinook salmon," several of these are listed under the ESA as part of the ESU.

HCS Chum Salmon

On March 24, 1999, NMFS listed naturally produced HCS chum salmon as a threatened species (64 FR 14508). The ESU comprises all naturally spawned populations of summer-run chum salmon in Hood Canal and its tributaries as well as populations in Olympic Peninsula rivers between Hood Canal and Dungeness Bay, Washington.

Chum salmon in this ESU are summer-run fish. Juveniles (typically the fry stage) outmigrate to seawater almost immediately after emergence from the gravel and reside for their first few weeks in the top two to three centimeters of estuarine surface waters and extremely close to the shoreline (WDFW and the Point No Point Treaty (WDFW/PNPT) 2000). Subadults and adults forage in coastal and offshore waters of the North Pacific Ocean before returning to spawn in their natal streams. HCS chum salmon spawn from mid-September to mid-October (whereas fall-run chum salmon in the same geographic area spawn from November to December or January). Spawning typically occurs in the mainstem and lower portions of river basins. Adults typically mature between the ages of 3 and 5. Hatchery chum salmon are also distributed within the range of this ESU.

Overview—Status of the PS chinook salmon

To determine a species' status under extant conditions (usually termed "the environmental baseline"), it is necessary to ascertain the degree to which the species' biological requirements are being met at that time and in that action area. For the purposes of this consultation, PS chinook salmon's biological requirements are expressed in two ways: population parameters such as fish numbers, distribution, and trends through-out the action area; and the condition of various essential habitat features such as water quality, substrate condition, and food availability. Clearly, these two types of information are interrelated; the condition of a given habitat has a great deal of impact on the number of fish it can support. Nonetheless, it is useful to separate the species' biological requirements into these parameters because doing so is a good way to get a full picture of all the factors affecting PS chinook salmon survival and their response to those factors. Therefore, the discussion to follow will be divided into two parts: (1) Species Distribution and Trends, and (2) Factors Affecting the Environmental Baseline.

PS Chinook Salmon Distribution and Trends

NMFS has performed little formal modeling of extinction risk for the Puget Sound chinook ESU. However, the March 24, 1999 (64 FR 14308), listing determination and supporting species status reviews (NMFS 1998a; NMFS 1998b) provide relevant and recent information regarding the ESU's status. Based on the total Puget Sound catch in 1908 (when both ocean harvest and hatchery production were negligible), Bledsoe et al. (1989) estimated an historical abundance of

670,000 chinook salmon in this ESU. This estimate, as with other historical estimates, should be viewed cautiously. Puget Sound cannery pack probably included a portion of fish landed at Puget Sound ports but originating in adjacent areas, and cannery pack represents only a portion of the total catch.

Recent spawning escapement data for this ESU are summarized in a chinook harvest management plan prepared by the WDFW and Tribal resource managers (Table 3). That plan addressed 15 chinook salmon "management units" encompassing all listed chinook salmon populations in the Puget Sound ESU: (1) Nooksack early, (2) Skagit spring, (3) Skagit summer/fall, (4) Stillaguamish summer/fall, (5) Snohomish, (6) Lake Washington summer/fall,(7) Green summer/fall, (8) White River, (9) Puyallup, (10) Nisqually, (11) Mid-Hood Canal, (12) Skokomish, (13) Dungeness, (14) Elwha, and (15) Western Strait. Throughout this document the reporting information including maps—is organized by the watersheds defined by USGS Hydrologic Unit Code (HUC) (Figure 1) which encompass these “management units.”

Escapement estimates compiled since 1998 (i.e., the time of the last NMFS status review for this species) indicate that between 40,000 and 48,000 naturally-produced chinook salmon have escaped to spawn in the range of the 15 management units (WDFW and PSIT, 2001). Though escapement trends have turned positive for many populations, 10 of these populations are influenced by hatchery production (WDFW and PSIT 2001). Table 4 shows the known spawning aggregations of chinook salmon within the Puget Sound ESU by Geographic area. Nomenclature follows that described in the Salmon and Steelhead Stock Inventory (SASSI) document (WDF et al. 1993).

The distribution of negative and positive population trends is very uneven in Puget Sound. The positive trends are associated with populations having high hatchery influence, while negative trends are found in populations supported primarily by natural production. These data and others (e.g., declining recruit/spawner ratios in Skagit River populations) continue to raise serious concerns about the sustainability of natural chinook salmon populations in Puget Sound.

HCS Chum Salmon Distribution and Trends

NMFS has performed little formal modeling of extinction risk for the HCS chum salmon ESU. However, the March 25, 1999 (64 FR 14508) listing determination and supporting species status reviews (NMFS 1997, NMFS 1999a) provide relevant and recent information regarding the ESU’s status.

Table 3. Spawning escapements (WDFW and PSIT, 2001) and juvenile outmigration estimates for Puget Sound natural chinook management units based on preliminary 2000 escapement

estimates.

Geographic Area/ Management Unit	1998	1999	2000	Outmigration estimates (2000)*
Nooksack/Samish				**607,200**
Nooksack early	523	1124	1518	303,600
North Fork	366	911	1235	247,000
South Fork	157	213	283	56,600
Skagit				**3,590,000**
Skagit spring	1086	471	1021	204,000
Skagit summer/fall	14609	4924	16930	3,386,000
Stillaguamish				**328,400**
Stillaguamish summer/fall	1544	1098	1643	328,400
Snohomish				**1,218,400**
Snohomish summer/fall	6304	4799	6092	1,218,400
Lake Washington				**24,000**
Cedar River	432	241	120	24,000
Green/Duwamish				**1,234,000**
Green River fall	7312	9100	6170	1,234,000
Puyallup				**542,800**
White River spring	316	553	1523	304,400
Puyallup fall	4995	1986	1193	238,400
South Prairie				
Nisqually				
Nisqually fall	834	1399	-----------	
Hood Canal				**1,062,800**
Mid Hood Canal	287	873	438	87,600
Skokomish	6911	10,044	4876	975,200
Dungeness/Elwha				**458,400**
Dungeness	110	75	218	43,600
Elwha River	2409	1606	2074	414,800

*Outmigration estimates are based on the number of spawning female escapements and the estimated survival rate from egg to smolt. Further information is provided on page 29 of NMFS (2002).

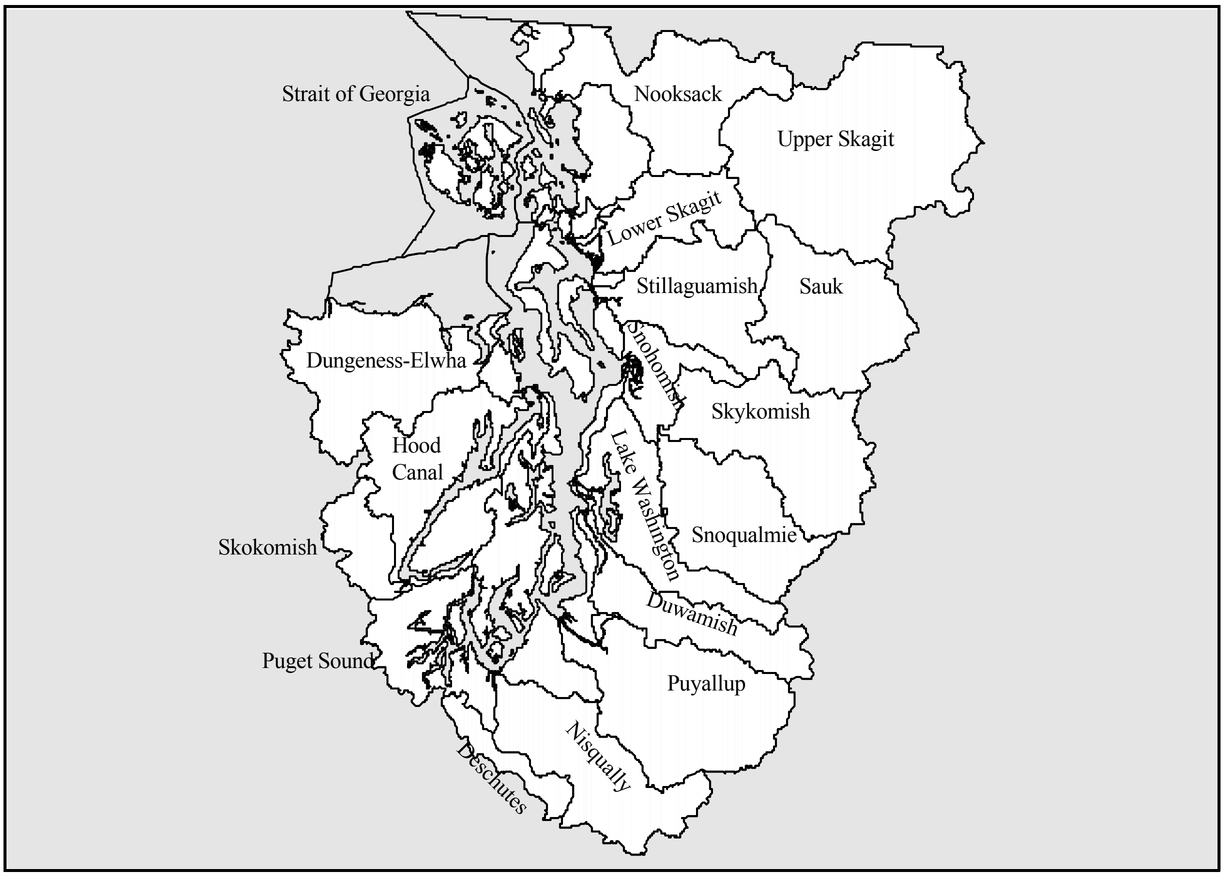

Figure 1. Watershed basins and drainages defined by USGS Hydrologic Unit Code (HUC).

Table 4. Known spawning aggregations of chinook salmon within the Puget Sound ESU by Geographic area.

Geographic Area	SASSI stock	Spawning aggregation
		Swamp Creek
		Bear Creek
		Little Bear Creek
		Thornton Creek
		McAleer Creek
		Cottage Lake Creek
		Sammamish River
	Cedar summer/fall	mainstem
Duwamish/Green	Duwamish/Green summer fall	Duwamish River
		Green River
		Newaukum Creek
Puyallup	White (Puyallup) spring	mainstem
		Clearwater River
		Greenwater River
		West Fork White River
	White (Puyallup) summer/fall	Mainstem
	Puyallup fall	mainstem
		South Prairie Creek
		Carbon River
Nisqually	Nisqually summer/fall	Mainstem
		Ohop Creek
		Mashel River
South Sound	South Sound tributaries summer/fall	McAllister Creek
		Grovers Creek
		Gorst Creek
		Chambers Creek
		Carr Inlet streams
		Deschutes River
Hood Canal	Hood Canal	Skokomish River
		Hamma Hamma River
		Dosewallips River
		Duckabush River
		Union River
		Tahuya River
		Dewatto River
Strait of Juan de Fuca	Dungeness spring/summer	mainstem
		Gray Wolf River
	Elwha/Morse Creek summer/fall	Elwha River

Table 4 (Continued).

Geographic Area	SASSI stock	Spawning aggregation
		Swamp Creek
		Bear Creek
		Little Bear Creek
		Thornton Creek
		McAleer Creek
		Cottage Lake Creek
		Sammamish River
	Cedar summer/fall	mainstem
Duwamish/Green	Duwamish/Green summer fall	Duwamish River
		Green River
		Newaukum Creek
Puyallup	White (Puyallup) spring	mainstem
		Clearwater River
		Greenwater River
		West Fork White River
	White (Puyallup) summer/fall	Mainstem
	Puyallup fall	mainstem
		South Prairie Creek
		Carbon River
Nisqually	Nisqually summer/fall	Mainstem
		Ohop Creek
		Mashel River
South Sound	South Sound tributaries summer/fall	McAllister Creek
		Grovers Creek
		Gorst Creek
		Chambers Creek
		Carr Inlet streams
		Deschutes River
Hood Canal	Hood Canal	Skokomish River
		Hamma Hamma River
		Dosewallips River
		Duckabush River
		Union River
		Tahuya River
		Dewatto River
Strait of Juan de Fuca	Dungeness spring/summer	mainstem
		Gray Wolf River
	Elwha/Morse Creek summer/fall	Elwha River
		Morse Creek

These reviews show summer-run chum salmon in Hood Canal spawning escapement (excluding the Union River) numbering more than 40,000 fish in 1968, but falling to only 173 fish in 1989. When petitions were filed with NMFS to list summer-run chum salmon in Hood Canal in 1994, of the 12 streams in Hood Canal the petitioners identified as having recently supported spawning populations of HCS chum salmon, six showed strong downward trends in abundance, and all were at low levels of abundance. The populations in Discovery Bay and Sequim Bay were also at low levels and declining.

In 1991, only seven of 12 streams that historically contained spawning runs of HCS chum salmon still had escapements. Then in 1995–96, escapement increased to more than 21,000 fish in northern Hood Canal, the largest return in more than 20 years. These increases in escapement were observed primarily in rivers on the west side of Hood Canal, with the largest increase occurring in the Big Quilcene River where the U.S. Fish and Wildlife Service (USFWS) began conducting an enhancement Program during the 1992 brood year. Streams on the east side of Hood Canal continued to have either no returning adults (Big Beef Creek, Anderson Creek, and the Dewatto River) or no increases in escapement (Tahuya and Union Rivers).

Summer runs of chum salmon in the Strait of Juan de Fuca (Snow and Salmon Creeks in Discovery Bay and Jimmycomelately Creek in Sequim Bay) are also part of this ESU. While these populations have not demonstrated the marked declining trend that has characterized the summer-run populations in Hood Canal in recent years, they are at very low population levels. Furthermore, though escapement of summer-run chum salmon to Salmon Creek increased in 1996, the other two populations in the Strait of Juan de Fuca did not show similar increases and the overall trend in the Strait populations has been one of continued decline.

The five-year average approximated 10,000 escapements for this ESU with estimated numbers varying from 2,601 fish in 1994 to 21,598 fish in 1996 for total escapements in the Hood Canal and the Strait of Juan de Fuca (WDFW/PNPT 2000). NMFS estimates an outmigration of 1,444,000 juvenile chum salmon based on the five-year average, the number of spawning female escapements, and the estimated survival rate from egg to smolt. Further information is provided on page 35 of NMFS (2002).

The HCS chum salmon populations in this ESU are affected by different environmental and harvest impacts, and display varying stock status trends and survival patterns. Populations of Hood Canal and the Strait of Juan de Fuca summer chum have dropped in abundance, but at different times and with different trends of abundance. While the rate and pattern of decline varied by individual populations, all HCS chum populations (except Union River) experienced a decline after 1978. Some improvements in total run size and escapements have been noted in recent years; however, some individual populations are still experiencing very low escapements.

Factors Affecting the Environmental Baseline

Environmental baselines for biological opinions are defined by regulation at 50 CFR 402.02, which states that an environmental baseline is the physical result of all past and present state, Federal, and private activities in the action area along with the anticipated impacts of all proposed Federal projects in the action area (that have already undergone formal or early section 7 consultation). The environmental baseline for *this* biological opinion is therefore the result of the impacts that many activities (summarized below) have had on PS chinook and HCS chum salmon survival and recovery. The baseline is the culmination of these effects on these species' *biological requirements* and, by examining those individual effects, it is possible to derive the species' status in the action area.

The biological requirements for PS chinook and HCS chum salmon in the action area can best be expressed in terms of the essential features of their habitat. That is, the salmon require adequate: (1) substrate (especially spawning gravel), (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, and (10) migration conditions (65 FR 7764). The best scientific information presently available demonstrates that a multitude of factors, past and present, have contributed to the decline of west coast salmonids by adversely affecting these essential habitat features. NMFS reviewed much of that information in its recently completed Consultation (NMFS 2002). That review is summarized in the sections below.

Human-Induced Habitat Degradation

Bishop and Morgan (1996) identified a variety of habitat issues for streams in the range of these ESUs because of urbanization forest and agricultural practices including (1) changes in flow regime (all basins), (2) sedimentation (all basins), (3) high temperatures (Dungeness, Elwha, Green/Duwamish, Skagit, Snohomish, and Stillaguamish Rivers), (4) streambed instability (most basins), (5) estuarine loss (most basins), (6) loss of large woody debris (Elwha, Snohomish, and White Rivers), (7) loss of pool habitat (Nooksack, Snohomish, and Stillaguamish Rivers), and (8) blockage or passage problems associated with dams or other structures (Cedar, Elwha, Green/Duwamish, Snohomish, and White Rivers). Further, aquaculture practices have played a role in degrading riverine and estuarine habitats. These activities and habitat modifications have greatly degraded extensive areas of salmon spawning and rearing habitat in the Puget Sound. The rising population density in parts of Washington will continue to adversely affect the quality and quantity of local water resources for chinook and chum salmon.

To counteract all the negative effects listed in this section, Federal, state, tribal, and private entities have—singly and in partnership—begun recover efforts to help slow and, eventually, reverse the decline of salmon and steelhead populations. Notable efforts within the range of PS chinook are the Wild Stock Restoration Initiative, Joint Wild Salmonid Policy, Shorelines Management Act, and the Northwest Forest Plan. Nevertheless, despite these efforts, much remains to be done to recover these species and other salmonids in the Puget Sound Basin.

Hatcheries

PS chinook salmon

Fall-, summer-, and spring-run chinook salmon stocks are artificially propagated in Puget Sound. Currently, the majority of production is devoted to fall-run (also called summer/fall) stocks for the purpose of enhancing fisheries. Conversely, approximately half of the depressed spring- and summer-run stocks recognized by WDF et al. (1993) are under captive culture or supplementation programs. Captive broodstock/recovery programs for spring-run chinook salmon have been undertaken on the White River (Appleby and Keown 1994) and the Dungeness River (Smith and Sele 1995). Supplementation programs currently exist for spring-run chinook salmon on North Fork Nooksack River and for summer-run chinook salmon on the Stillaguamish and Skagit Rivers (Fuss and Ashbrook 1995, Marshall et al. 1995).

HCS chum salmon

The WDFW, Point No point Treaty Tribes and USFWS initiated supplementation projects in 1992 on the Big Quilcene River (WDFW/PNPT 2000). Also in 1992, conservation groups—under the supervision of WDFW—began supplementing Lilliwaup Creek and Salmon Creek. The initial success of the Big Quilcene River and Salmon Creek project is indicated by the high returns in recent years. The group's difficulties collecting brood stock and desire to minimize impacts on natural spawning in the creek have resulted in the Lilliwaup Creek program being an intermittent, low production project (WDFW/PNPT 2000). A project to supplement summer chum salmon in the Hamma Hamma River in 1997 encountered similar difficulties (WDFW/PNPT 2000). More recently the WDFW, University of Washington, and a volunteer group have been directing their efforts toward reintroducing HCS chum salmon into streams where they were extirpated (WDFW/PNPT 2000).

More recently, the role hatcheries are playing in the recovery of Hood Canal and Strait of Juan de Fuca summer chum stocks is being redefined under the Summer Chum Salmon Conservation Initiative (WDFW/PNPT 2000). The plan identifies specific actions and strategies to protect and restore the populations. The recovery goal will institute rigorous criteria for the release of hatchery salmonids to greatly reduce potential negative impacts on summer run salmon. In addition, if co-managers assessing individual stocks find any at risk of extinction, hatchery supplementation using local brood stock will be used to sustain and recover the stock.

Effects of Hatchery Fish

Hatchery fish can harm naturally-produced salmon in four primary ways: (1) ecological effects, (2) genetic effects, (3) overharvest effects, and (4) masking effects (NMFS 2000c).

Ecologically, hatchery fish can prey upon, displace, and compete with wild fish. These effects are most likely to occur when fish are released in poor condition and do not migrate to marine waters, but rather remain in the streams for extended rearing periods. Hatchery fish also may transmit hatchery-borne diseases, and hatcheries themselves may release disease-carrying effluent into streams. Hatchery fish can affect the genetic composition of native fish by interbreeding with them. Interbreeding can also be caused by humans taking native fish from one area and using them in a hatchery program in another area. Interbred fish are less adapted to the local habitats where the original native stock evolved and may therefore be less productive there.

<u>Harvest</u>

PS Chinook Salmon

Fisheries in Puget Sound have sometimes been managed poorly because "maximum sustainable yield" rates have been identified incorrectly in light of declining productivity of natural chinook salmon stocks. High harvest rates directed at hatchery stocks have caused many stocks to fail to meet natural escapement goals in most years (USFWS 1996). Harvest impacts on Puget Sound chinook salmon stocks have been quite high. Salmon are also taken incidentally in the groundfish and whiting fishery off Washington, Oregon, and California (NMFS 1996a).

Co-managers implemented several strategies to manage the recreational harvest. Time/area closures are used to reduce catches of weak stocks in directed fisheries and to reduce chinook bycatch in other fisheries. Other regulations, such as size limits, bag limits, and barbless hooks are also used. Most recently, managers have begun using mass marking and selective fishing practices to protect natural stocks.

HCS Chum Salmon

Historically, HCS chum salmon have not been a primary fishery target in Hood Canal because harvests have focused on chinook, coho, and fall chum salmon. However, HCS chum salmon have a run timing that overlaps those of chinook and coho salmon, and they have been incidentally harvested in fisheries directed at those species (Tynan 1992). In 1974, commercial fisheries were opened in Hood Canal and incidental harvest rates on HCS chum salmon began to increase rapidly. Beginning in 1992, fishing practices there were modified (changes in gear, seasons, and fishing locations) to protect HCS chum salmon (WDFW 1996).

The harvest of HCS chum salmon was identified as one of the factors contributing to their decline (WDFW/PNPT 2000). Conservation activities under the Summer Chum Salmon Conservation Initiative (2000) will limit the incidental summer chum harvests in Washington terminal and pre-terminal fisheries to levels that will minimize impacts on these stocks.

Natural Conditions

Recent declines in fish populations in Puget Sound may reflect increased predation and recent climatic shifts. NMFS has noted that predation by marine mammals has increased as marine mammal numbers, especially harbor seals (*Phoca vitulina*) and California sea lions (*Zalophus californianus*) increase on the Pacific Coast (NMFS 1988). In addition to predation by marine mammals, Fresh (1997) reported that 33 fish species and 13 bird species are predators of juvenile and adult salmon, particularly during freshwater rearing and migration stages.

Changes in climate and ocean conditions happen on several different time scales and have had profound influence on distributions and abundances of marine and anadromous fishes. Recent evidence suggests that marine survival among salmonids fluctuates in response to 20- to 30-year cycles of climatic conditions and ocean productivity (Hare et al. 1999). Although recent climatic conditions appear to be within the range of historical conditions, the risks associated with climatic changes are probably exacerbated by human activities (Lawson 1993).

Scientific Research

PS chinook and HCS chum salmon, like other ESA-listed fish, are the subject of scientific research and monitoring activities. Most biological opinions issued by NMFS have conditions requiring specific monitoring, evaluation, and research projects to gather information to aid the survival of listed fish. Recently, NMFS issued numerous research permits/authorizations allowing takes of PS chinook and HCS chum salmon (NMFS 2002a, 2002b) which are summarized in the following table.

Table 5. Total Authorized take of Threatened PS Chinook Salmon and HCS Chum Salmon

	PS CHINOOK SALMON				HCS CHUM SALMON			
	ADULT		JUVENILE		ADULT		JUVENILE	
	NON-LETHAL	LETHAL	NON-LETHAL	LETHAL	NON-LETHAL	LETHAL	NON-LETHAL	LETHAL
SECTION 10 RESEARCH	19	0	72,145	1,193	0	0	11	3
4(d) RESEARCH	125	7	94,127	2,903	0	0	90,600	870
TOTAL	144	7	166,272	4,096	0	0	90,611	873

Each authorization for take by itself would not lead to decline of the species. However the sum of the authorized takes indicate a high level of research effort in the action area. The effect of these activities is difficult to assess because despite the fact that fish are harassed and even killed in the course of scientific research, these activities have a great potential to benefit to ESA-listed species. For example, aside from simply increasing what is known about the listed species and their biological requirements, research is essentially the only way to answer key questions associated with difficult resource issues that crop up in every management arena and involve every salmonid life history stage (particularly the resource issues discussed in the previous sections). Most importantly, the information gained during research and monitoring activities will help resource managers plan for the recovery of listed species. That is, no rational resource allocation or management decisions can be made without the knowledge to back them up. Further, there is no way to tell if the corrective measures described in the previous sections are working unless they are monitored, and there is no way to design new and better approaches if research is not done.

In any case, scientific research and monitoring efforts (unlike the other factors described in the previous sections) are not considered to be a factor contributing to the decline of PS chinook and HCS chum salmon, and NMFS believes that the information derived from the research activities is essential to their survival and recovery. Nonetheless, fish *are* harmed during research activities and activities that are carried out in a careless or undirected fashion are not likely to benefit the species at all. Therefore, to minimize any harm arising from research activities on the species, NMFS imposes conditions in its permits so that permit holders reduce adverse effects on the ESA-listed species, including keeping mortalities as low as possible. Researchers are encouraged to use non-listed fish species and hatchery fish instead of listed naturally-produced fish when possible. Also, researchers are required to share sampled fish, as well as the results of the scientific research, with other researchers and comanagers in the region as a way to avoid duplicative research efforts and to acquire as much information as possible from the ESA-listed fish sampled. NMFS also works with other agencies to coordinate research and thereby prevent duplication of effort.

For projects that require an ESA section 10(a)(1)(A) permit, applicants provide NMFS with high take estimates to compensate for potential in-season changes in research protocols, accidental catastrophic events, and the annual variability in listed fish numbers. Also, most research projects depend on annual funding and the availability of other resources. So, a specific research project for which take of ESA-listed species is authorized by a permit may be suspended in a year when funding or resources are not available. As a result, the *actual* take in a given year for most research projects, as provided to NMFS in post-season annual reports, is usually less than the authorized level of take in the permits and the related NMFS consultation on the issuance of those permits. Therefore, because actual take levels tend to be lower than authorized takes, the severity of effects to the ESA-listed species to result from the conduct of scientific research activities are usually less than the effects analyzed in a typical research permit consultation.

<u>Summary</u>

The picture of whether PS chinook and HCS chum salmon biological requirements are being met is clear-cut for habitat-related parameters and for population factors; given all the factors for decline—even taking into account the corrective measures being implemented[1]—it is clear that their biological requirements are currently not being met under the environmental baseline. Their status is such that there must be a significant improvement in the environmental conditions of the species' respective habitats (over those currently available under the environmental baselines). Any further degradation of the environmental conditions would have a significant impact due to the amount of risk the species presently face under the environmental baselines. In addition, there must be considerable improvements to minimize effects due to hydropower dams, incidental harvest, hatchery practices, and unfavorable estuarine and marine conditions.

EFFECTS OF THE ACTION

The purpose of this section is to identify the effects NMFS' issuance of scientific research permits will have on threatened PS chinook and HCS chum salmon. To the extent possible, this will include analyses of effects at the population level. Where information on these ESUs is scarce at the population level (or naturally spawning populations are not presently assigned to an independent population), this analysis assumes that the status of each affected population is the same as the ESU as a whole. Analyses of effects also include hatchery stocks NMFS considers essential to the ESU's recovery. NMFS concluded that five of the hatchery chinook salmon stocks identified as part of the PS chinook salmon ESU should be listed since they are currently essential for its recovery (NMFS 1999d). The listed hatchery stocks are: Kendall Creek (spring run); North Fork Stillaguamish River (summer run); White River (spring run); Dungeness river (spring run); and Elwha River (fall run). Table 5 summarizes the 2001 hatchery production goal and actual releases. Hatchery production goals for 2002 have not substantially increased. HCS chum salmon do not have a corresponding hatchery stock essential to the ESUs recovery. This analysis consists of (a) the general effects scientific research activities are known to have (including the effects arising from mitigation efforts) and (b) permit-specific effects.

Evaluating the Effects of the Action

Over the course of several years and numerous ESA section 7 consultations, NMFS developed the following four-step approach for using the ESA Section 7(a)(2) standards to determine what

[1] Please see the following documents for a summary of conservation efforts: Steelhead Conservation Efforts: A Supplement to the Notice of Determination for West Coast Steelhead Under the Endangered Species Act, August 1996; Coastal Salmon Conservation Working Guidance for Comprehensive Salmon Restoration Initiatives on the Pacific Coast, September 15, 1996; NOAA Technical Memorandum NMFS-NWFSC-42, June 2000, Viable Salmon Populations and the Recovery of Evolutionarily Significant Units.

Table 6. Listed hatchery stocks. Production goals and actual production for 2001.

Brood Stock	**Production Goal***		**Actual Production†**
	Fry	Fingerling	
Kendall Creek (spring-run)	500,000	1.6 million	**1.7 million**
North Fork Stillaguamish River (summer-run)	--------	220,000	**192,789**
White River (spring-run)	1 million	180,000	**699,100** 344,100 (Minter Creek) 355,000 (White River)
Dungeness river (spring-run)	800,000	1.175 million	**2.821 million**
Elwha River (fall-run)	-------	3.85 million	**2.583 million**

*Tim Tynan, NMFS. Pers. Comm. to C. Bill, Oct. 6, 2001.
† Muckelshoot and Stilliguamish Tribal and WDFW biologists. Pers. Comm. to C. Bill, Sept. 25, 2001.

effect a proposed action is likely to have on a given listed species. What follows here is a summary of that approach[2].

1. Define the biological requirements and current status of each listed species.

2. Evaluate the relevance of the environmental baseline to the species' current status.

3. Determine the effects of the proposed or continuing action on listed species and their habitat.

4. Determine whether the species can be expected to survive with an adequate potential for recovery under (a) the effects of the proposed (or continuing) action, (b) the effects of the environmental baseline, and (c) any cumulative effects—including all measures being taken to improve salmonid survival and recovery.

The fourth step above requires a two-part analysis. The first part focuses on the action area and defines the proposed action's effects in terms of the species' biological requirements in that area (i.e., impacts on essential habitat features). The second part focuses on the species itself. It

describes the action's impact on individual fish—or populations, or both—and places that impact in the context of the ESU as a whole. Ultimately, the analysis seeks to answer the questions of whether the proposed action is likely to jeopardize a listed species' continued existence or destroy or adversely modify its habitat.

Effects on the Habitat

Previous sections have described the essential features of PS chinook and HCS chum salmon habitat, and depicted its present condition. The discussion here focuses on how those features are likely to be affected by the proposed actions.

Full descriptions of the proposed activities are found in the next section. In general, the activities will be (a) electrofishing using backpack equipment, (b) streamside and snorkel surveys in spawning and rearing habitat, and (c) capturing fish with angling equipment, traps, and nets of various types. All of these techniques are minimally intrusive in terms of their effect on habitat. None of them will measurably affect any of the 10 essential fish habitat features listed earlier (i.e., stream substrates, water quality, water quantity, food, streamside vegetation,

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[2]For more detail please see pages 4-10 of *The Habitat Approach: Implementation of Section 7 of the Endangered Species Act for Actions Affecting the Habitat of Pacific Salmonids* (NMFS 1999e).

etc.). Moreover, the proposed activities are all of short duration. Therefore, NMFS concludes that the proposed activities are unlikely to adversely modify PS chinook salmon habitat.

Effects on PS Chinook and HCS Chum Salmon

The primary effects the proposed activities will have on PS chinook and HCS chum salmon will be in the form of direct "take" (the ESA take definition is given in the section introducing the individual permits) usually in the form of harassment. Harassment generally leads to stress and other sub-lethal effects and is caused by observing, capturing, and handling fish. The ESA does not define harassment nor has NMFS defined this term through regulation. However, the USFWS defines harassment as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to breeding, feeding or sheltering" [50 CFR 17.4]. For the purposes of this analysis, NMFS adopts this definition of harassment.

As Table 1 illustrates, the various proposed activities would cause many types of take, and while it is not clearly perceptible between what constitutes an activity (e.g., electrofishing) and what constitutes a take category (e.g., harm), it is important to keep the two concepts separate. The reason for this is that the effects being measured here are those which the activity itself has on the listed species. They may be expressed in *terms* of the take categories (e.g, how many PS chinook salmon are harmed, or harassed, or even killed), but the actual mechanisms of the effects themselves (i.e., the activities) are the causes of whatever take arises and, as such, they bear examination. Therefore, the first part of this section is devoted to a discussion of the general effects known to be caused by the proposed activities, regardless of where they occur or what species are involved.

The following subsections constitute a comprehensive list of the types of activities being proposed. Because they would all be carried out by trained professionals using established protocols and have widely recognized specific impacts, each description is broadly applicable to every proposed permit. Researchers do not receive a permit unless their activities (e.g., electrofishing) incorporate NMFS' uniform, pre-established set of mitigation measures.

<u>Observation</u>

For some studies, ESA-listed fish will be observed in-water (i.e. snorkel surveys): direct observation is the least disruptive and simplest method for determining presence/absence of the species and estimating their relative abundance. Its effects are also generally the shortest-lived among any of the research activities discussed in this section. Typically, a cautious observer can effectively obtain data without disrupting the normal behavior of a fish. Fry and juveniles frightened by the turbulence and sound created by observers are likely to seek temporary refuge behind rocks, vegetation, and deep water areas. In extreme cases, some individuals may temporarily leave the particular pool or habitat type when observers are in their area. Researchers minimize disturbance to fish by moving through streams slowly thus allowing ample time for fish to reach escape cover. During some of the research activities discussed below, redds may be visually inspected, but no redds will be walked on. Harassment is the primary form of take associated with these observation activities, and few if any injuries or deaths are expected to occur—particularly in cases where the observation is to be conducted solely by researchers on the stream banks rather than in the water. There is little a researcher can do to mitigate the effects associated with observation activities because those effects are so minimal. In general, all they can do is move with care and attempt to avoid disturbing sediments, gravels, and, to the extent possible, the fish themselves.

Capture/handling

Capturing and handling fish causes them stress—though they typically recover fairly rapidly from the process and therefore the overall effects of the procedure are generally short-lived. The primary contributing factors to stress and death from handling are excessive doses of anesthetic, differences in water temperatures (between the river and wherever the fish are held), dissolved oxygen conditions, the amount of time that fish are held out of the water, and physical trauma. Stress on salmonids increases rapidly from handling if the water temperature exceeds 18°C or dissolved oxygen is below saturation. Fish that are transferred to holding tanks can experience trauma if care is not taken in the transfer process, and fish can experience stress and injury from overcrowding in traps if the traps are not emptied on a regular basis. Debris buildup at traps can also kill or injure fish if the traps are not monitored and cleared on a regular basis.

Based on prior experience with the research techniques and protocols that would be used to conduct the proposed scientific research, no more than five percent of the juvenile salmonids encountered are likely to be killed as an indirect result of being captured and handled and, in most cases, that figure will not exceed three percent. In addition, it is not expected that more than one percent of the adults being handled will die. In any case, all researchers will follow the mitigation measures described earlier (page 3) and thereby keep adverse effects to a minimum. Finally, any fish indirectly killed by the research activities in the proposed permits may be retained as reference specimens or used for other research purposes.

Electrofishing

Electrofishing is a process by which an electrical current is passed through water containing fish in order to stun them—thus making them easy to capture. It can cause a suite of effects ranging form simple harassment to actually killing the fish. The amount of unintentional mortality attributable to electrofishing may vary widely depending on the equipment used, the settings on the equipment, and the expertise of the technician. Electrofishing can have severe effects on adult salmonids. Spinal injuries in adult salmonids from forced muscle contraction have been documented. Sharber and Carothers (1988) reported that electrofishing killed 50 percent of the adult rainbow trout in their study. The long-term effects electrofishing has on both juveniles and adult salmonids are not well understood, but long experience with electrofishing indicates that most impacts occur at the time of sampling and are of relatively short duration.

The effects of electrofishing on PS chinook and HCS chum salmon would be limited to the direct and indirect effects of exposure to an electric field, capture by netting, holding captured fish in aerated tanks, and the effects of handling associated with transferring the fish back to the river (see the next subsection for more detail on capturing and handling effects). Most of the studies on the effects of electrofishing on fish have been conducted on adult fish greater than 300 mm in length (Dalbey et al. 1996). The relatively few studies that have been conducted on juvenile salmonids indicate that spinal injury rates are substantially lower than they are for large fish. Smaller fish intercept a smaller head-to-tail potential than larger fish (Sharber and Carothers 1988) and may therefore be subject to lower injury rates (e.g., Hollender and Carline 1994, Dalbey et al. 1996, Thompson et al. 1997). McMichael et al. (1998) found a 5.1% injury rate for juvenile MCR steelhead captured by electrofishing in the Yakima River subbasin. The incidence and severity of electrofishing damage is partly related to the type of equipment used and the waveform produced (Sharber and Carothers 1988, McMichael 1993, Dalbey et al. 1996, Dwyer and White 1997). Continuous direct current (DC) or low-frequency ($\leq$30 Hz) pulsed DC have been recommended for electrofishing (Fredenberg 1992, Snyder 1992, 1995, Dalbey et al. 1996) because lower spinal injury rates, particularly in salmonids, occur with these waveforms (Fredenberg 1992, McMichael 1993, Sharber et al. 1994, Dalbey et al. 1996). Only a few recent studies have examined the long-term effects of electrofishing on salmonid survival and growth (Dalbey et al. 1996, Ainslie et al. 1998). These studies indicate that although some of the fish suffer spinal injury, few die as a result. However, severely injured fish grow at slower rates and sometimes they show no growth at all (Dalbey et al. 1996).

NMFS' electrofishing guidelines (NMFS 2000c) will be followed in all surveys requiring this procedure. The guidelines require that field crews be trained in observing animals for signs of stress and shown how to adjust electrofishing equipment to minimize that stress. Electrofishing is used only when other survey methods are not feasible. All areas for stream and special needs surveys are visually searched for fish before electrofishing may begin. Electrofishing is not done in the vicinity of redds or spawning adults. All electrofishing equipment operators are trained by qualified personnel to be familiar with equipment handling, settings, maintenance, and safety. Operators work in pairs to increase both the number of fish that may be seen and the ability to identify individual fish without having to net them. Working in pairs also allows the researcher to net fish before they are subjected to higher electrical fields. Only DC units will be used, and the equipment will be regularly maintained to ensure proper operating condition. Voltage, pulse width, and rate will be kept at minimal levels and water conductivity will be tested at the start of every electrofishing session so those minimal levels can be determined. Due to the low settings used, shocked fish normally revive instantaneously. Fish requiring revivification will receive immediate, adequate care.

The preceding discussion focused on the effects of using a backpack unit for electrofishing and the ways those effects will be mitigated. It should be noted, however, that in larger streams and rivers electrofishing units are sometimes mounted on boats. These units often use more current than backpack electrofishing equipment because they need to cover larger (and deeper) areas and, as a result, can have a greater impact on fish. In addition, the environmental conditions in larger, more turbid streams can limit researchers' ability to minimize impacts on fish. For example, in areas of lower visibility it is difficult for researchers to detect the presence of adults and thereby take steps to avoid them. Because of its greater potential to harm fish, and because NMFS has not published appropriate guidelines, boat electrofishing has not been given a general authorization under NMFS' recent ESA section 4(d) rules. However, it is expected that guidelines for safe boat electrofishing will be in place in the near future. And in any case, all researchers intending to use boat electrofishing will use all means at their disposal to ensure that a minimum number of fish are harmed (these means will include a number of long-established protocols that will eventually be incorporated int NMFS' guidelines).

<u>Tagging/Marking</u>

Techniques such as PIT-tagging (passive integrated transponder tagging), coded wire tagging, fin-clipping, and the use of radio transmitters are common to many scientific research efforts using ESA-listed species. All sampling, handling, and tagging procedures have an inherent potential to stress, injure, or even kill the marked fish. This section discusses each of the marking processes and its associated risks.

A PIT tag is an electronic device that relays signals to a radio receiver; it allows salmonids to be identified whenever they pass a location containing such a receiver (e.g., any of several dams) without researchers having to handle the fish again. The tag is inserted into the body cavity of the fish just in front of the pelvic girdle. The tagging procedure requires that the fish be captured and extensively handled, therefore any researchers engaged in such activities will follow the conditions listed on page 3 of this Opinion (as well as any permit-specific terms and conditions) to ensure that the operations take place in the safest possible manner. In general, the tagging operations will take place where there is cold water of high quality, a carefully controlled environment for administering anesthesia, sanitary conditions, quality control checking, and a carefully regulated holding environment where the fish can be allowed to recover from the operation.

PIT tags have very little effect on growth, mortality, or behavior. The few reported studies of PIT tags have shown no effect on growth or survival (Prentice et al. 1987; Jenkins and Smith 1990; Prentice et al. 1990). For example, in a study between the tailraces of Lower Granite and

McNary Dams (225 km), Hockersmith et al. (2000) concluded that the performance of yearling chinook salmon was not adversely affected by gastrically- or surgically implanted sham radio tags or PIT-tags. Additional studies have shown that growth rates among PIT-tagged Snake River juvenile fall chinook salmon in 1992 (Rondorf and Miller 1992) were similar to growth rates for salmon that were not tagged (Conner et al. 2001). Prentice and Park (1984) also found that PIT-tagging did not substantially affect survival in juvenile salmonids.

Coded wire tags (CWTs) are made of magnetized, stainless-steel wire. They bear distinctive notches that can be coded for such data as species, brood year, hatchery of origin, and so forth (Nielsen 1992). The tags are intended to remain within the animal indefinitely, consequently making them ideal for making long-term, population-level assessments of Pacific Northwest salmon. The tag is injected into the nasal cartilage of a salmon and therefore causes little direct tissue damage (Bergman et al. 1968; Bordner et al. 1990). The conditions under which CWTs may be inserted are similar to those required for applying PIT-tags.

A major advantage to using CWTs is the fact that they have a negligible effect on the biological condition or response of tagged salmon; however if the tag is placed too deeply in the snout of a fish, it may kill the fish, reduce its growth, or damage olfactory tissue (Fletcher et al. 1987; Peltz and Miller 1990). This latter effect can create problems for species like salmon because they use olfactory clues to guide their spawning migrations (Morrison and Zajac 1987).

In order for researchers to be able to determine later (after the initial tagging) which fish possess CWTs, it is necessary to mark the fish externally—usually by clipping the adipose fin—when the CWT is implanted (see text below for information on fin clipping). One major disadvantage to recovering data from CWTs is that the fish must be killed in order for the tag to be removed. However, this is not a significant problem because researchers generally recover CWTs from salmon that have been taken during the course of commercial and recreational harvest (and are therefore already dead).

The other primary method for tagging fish is to implant them with radio tags. There are two main ways to accomplish this and they differ in both their characteristics and consequences. First, a tag can be inserted into a fish's stomach by pushing it past the esophagus with a plunger. Stomach insertion does not cause a wound and does not interfere with swimming. This technique is benign when salmon are in the portion of their spawning migrations during which they do not feed (Nielsen, 1992). In addition, for short-term studies, stomach tags allow faster post-tagging recovery and interfere less with normal behavior than do tags attached in other ways.

The second method for implanting radio tags is to place them within the body cavities of (usually juvenile) salmonids. These tags do not interfere with feeding or movement. However, the tagging procedure is difficult, requiring considerable experience and care (Nielsen 1992). Because the tag is placed within the body cavity, it is possible to injure a fish's internal organs.

Infections of the sutured incision and the body cavity itself are also possible, especially if the tag and incision are not treated with antibiotics (Chisholm and Hubert 1985, Mellas and Haynes 1985).

Fish with internal radio tags often die at higher rates than fish tagged by other means because radio tagging is a complicated and stressful process. Mortality is both acute (occurring during or soon after tagging) and delayed (occurring long after the fish have been released into the environment). Acute mortality is caused by trauma induced during capture, tagging, and release. It can be reduced by handling fish as gently as possible. Delayed mortality occurs if the tag or the tagging procedure harms the animal in direct or subtle ways. Tags may cause wounds that do not heal properly, may make swimming more difficult, or may make tagged animals more vulnerable to predation (Howe and Hoyt 1982, Matthews and Reavis 1990, Moring 1990). Tagging may also reduce fish growth by increasing the energetic costs of swimming and maintaining balance. As with the other forms of tagging and marking, researchers will keep the harm caused by radio tagging to a minimum by following the conditions given on page 3 of this Opinion, as well as any other permit-specific requirements.

Fin clipping is the process of removing part or all of one or more fins to alter a fish's appearance and thus make it identifiable. When entire fins are removed, it is expected that they will never grow back. Alternatively, a permanent mark can be made when only a part of the fin is removed or the end of a fin or a few fin rays are clipped. Although researchers have used all fins for marking at one time or another, the current preference is to clip the adipose, pelvic, or pectoral fins. Marks can also be made by punching holes or cutting notches in fins, or severing individual fin rays (Kohlhorst 1979, Welch and Mills 1981). Many studies have examined the effects of fin clips on fish growth, survival, and behavior. The results of these studies are somewhat variable; however, it can be said that fin clips do not generally alter fish growth. Studies comparing the growth of clipped and unclipped fish generally have shown no differences between them (e.g., Brynildson and Brynildson 1967). Moreover, wounds caused by fin clipping usually heal quickly—especially those caused by partial clips.

Mortality among fin-clipped fish is also variable. Some immediate mortality may occur during the marking process, especially if fish have been handled extensively for other purposes (e.g., stomach sampling). Delayed mortality depends, at least in part, on fish size; small fishes have often been found to be susceptible to it and Coble (1967) suggested that fish shorter than 90 mm are at particular risk. The degree of mortality among individual fishes also depends on which fin is clipped. Studies show that adipose- and pelvic-fin-clipped coho salmon fingerlings have a 100% recovery rate (Stolte 1973). Recovery rates for steelhead were 60% when the adipose fin was clipped and 52% when the pelvic fin was clipped and dropped markedly when the pectoral, dorsal, and anal fins were clipped (Nicola and Cordone 1973). Clipping the adipose and pelvic fins probably kills fewer fish because these fins are not as important as other fins for movement or balance (McNeil and Crossman 1979). Mortality is generally higher when the major median and pectoral fins are clipped. Mears and Hatch (1976) showed that clipping more than one fin may increase delayed mortality, but other studies have been less conclusive.

Regardless, any time researchers clip or remove fins, it is necessary that the fish be handled. Therefore, the same safe and sanitary conditions required for tagging operations also apply to clipping activities.

Stomach Flushing

Studies of the food and feeding habits of fish are important in the study of aquatic ecosystems, however food habit studies required researchers to kill fish for stomach removal and examination. Consequently, several methods were developed to remove stomach contents without injuring the fish. Most techniques use a rigid or semi-rigid tube to inject water into the stomach to flush out the contents.

Surprisingly, few assessments of associated mortality rates have been conducted with most nonlethal methods of examining fish stomach contents (Kamler and Pope, 2001). However, the following studies show that stomach flushing does not substantially affect survival in juvenile salmonids. Strange and Kennedy (1981) assessed the survival of salmonids subjected to stomach flushing and found no difference between stomach-flushed fish and control fish that were held for three to five days. In addition, Light et al. (1983) flushed the stomachs of electroshocked and anesthetized brook trout. Survival was 100% for the entire observation period. In contrast, Meehan and Miller (1978) determined the survival rate of electroshocked, anesthetized, and stomach flushed wild and hatchery coho salmon over a 30-day period to be 87% and 84% respectively.

Sacrifice

In some instances, it is necessary to kill a captured fish in order to gather whatever data a study is designed to produce. In such instances, determining the effect is very straightforward: The sacrificed fish, if juveniles, are forever removed from the ESU's gene pool. If the fish are adults, the effect depends upon whether they are killed before or after they have a chance to spawn. If they are killed after they spawn, there is very little overall effect save for removing the nutrients their bodies would have provided to the spawning grounds. If they are killed before they spawn, not only are they removed from the ESU, but so are all their potential progeny. Hence, killing pre-spawning adults has the greatest potential to affect their ESU and, consequently, NMFS rarely allows it to happen. If it is allowed, the adults are often stripped of sperm and eggs so their progeny can be raised in a controlled environment such as a hatchery—thereby greatly decreasing the potential harm posed by sacrificing the adults. Clearly, there is no way to mitigate the effects of sacrificing a fish.

Benefits of Research

Under section 10(d) of the ESA, NMFS is prohibited from issuing a section 10(a)(1)(A) permit unless NMFS finds that the permit (1) was applied for in good faith; (2) if granted and exercised, will not operate to the disadvantage of the endangered and/or threatened species that is/are the subject of the permit; and (3) is consistent with the purposes and policy of section 2 of the ESA. In addition, NMFS does not issue a section 10(a)(1)(A) permit unless the proposed activities are likely to result in a net benefit to the ESA-listed species that is/are the subject of the permit; benefits accrue from the acquisition of scientific information.

For more than a decade, research and monitoring activities conducted with anadromous salmonids in the Pacific Northwest have provided resource managers with a wealth of important and useful information on anadromous fish populations. For example, juvenile fish trapping efforts have enabled the production of population inventories, PIT-tagging efforts have increased the knowledge of anadromous fish migration timing and survival, and fish passage studies have provided an enhanced understanding of fish behavior and survival when moving past dams and through reservoirs. By issuing section 10(a)(1)(A) scientific research permits, NMFS will cause information to be acquired that will enhance the ability of resource managers to make more effective and responsible decisions to sustain anadromous salmonid populations that are at risk of extinction, to mitigate impacts to endangered and threatened chinook salmon and steelhead, and to implement recovery efforts. The resulting data will improve the knowledge of the respective species' life history, specific biological requirements, genetic make-up, migration timing, responses to anthropogenic impacts, and survival in the river system.

Permit-specific Effects

Effects of the proposed activities are discussed in the general effects section. Through permit conditions researchers will use measures discussed previously to mitigate adverse impacts on listed ESUs.

<u>Permit 1140 - Modification 3</u>

Permit 1140 would authorize the NWFSC to capture, handle, and release up to 319 juvenile, naturally-produced and 17 juvenile, artificially-propagated PS chinook salmon and capture, handle, mark, and release 5000 juvenile, naturally-produced PS chinook salmon. The permit would authorize the NWFSC to subsample 190 juvenile, naturally-produced and 10 artificially-propagated PS chinook salmon captured for stomach content analysis (using nonlethal evacuation). The permit would also allow NWFSC to kill no more than 417 juvenile, naturally-produced and two artificially-propagated PS chinook salmon as an indirect result of being captured and sampled for stomach contents.

Since all of the sampling for these projects will occur in Puget Sound nearshore marine areas in central Puget Sound and in the Skagit River basin it is not possible to determine the effects on a single breeding population in this ESU. However, NMFS roughly estimates eight million juvenile, naturally produced PS chinook salmon will outmigrate to the Puget Sound Basin in addition to 355,000 juvenile, artificially-propagated White River PS chinook salmon stock outmigrating to the project areas. If this outmigration is typical for future years, the annual loss of up to 417 juvenile, naturally-produced and two artificially-propagated PS chinook salmon associated with the NWFSC's research (indirect mortalities due to handling) will not have a measurable impact on the PS chinook salmon ESU.

Permit 1309

Permit 1309 would authorize the KCDNR to lethally take up to 10 juvenile, artificially-propagated PS chinook salmon. The research will be conducted in various Puget Sound nearshore marine areas and river systems throughout King County, hence it is not possible to determine the effects on a single breeding population in this ESU. However, NMFS roughly estimates eight million juvenile naturally-produced PS chinook salmon will outmigrate to the Puget Sound Basin in addition to 355,000 juvenile, artificially-propagated White River PS chinook salmon stock outmigrating to the project areas. If this outmigration is typical for future years, the annual loss of up to 10 juvenile, artificially-propagated PS chinook salmon associated with the KCDNR's research will not have a measurable impact on the status of PS chinook salmon ESU.

Permit 1381

Permit 1381 would authorize the City of Bellingham to capture, handle, and release up to 20 juvenile, naturally-produced PS chinook salmon and 40 juvenile, artificially-propagated PS chinook salmon. The permit would also allow the City of Bellingham to kill no more than two juvenile, naturally-produced PS chinook salmon and two juvenile, artificially-propagated PS chinook salmon as an indirect result of being captured. Sampling activities will occur in the Nooksack/Samish River Basin.

NMFS estimates an outmigration of over 600,000 juvenile, naturally-produced PS chinook salmon and 1.7 million juvenile, artificially-propagated PS chinook salmon (Kendall Creek stock) from the Nooksack/Samish River Basin. If juvenile, PS chinook salmon outmigration is typical for future years in this river system, the annual loss of up to two juvenile, naturally-produced PS chinook salmon two artificially-propagated PS chinook salmon associated with the City of Bellingham's research (indirect mortalities due to handling) will not have a measurable impact on the PS chinook salmon population directly effected and the ESU as a whole.

Permit 1386

Permit 1386 would authorize the DOE to capture, handle, and release up to 190 juvenile, naturally-produced chinook salmon, 50 juvenile, artificially-propagated PS chinook salmon, 48 adult PS chinook salmon, 20 juvenile HCS chum salmon, and four adult HCS chum salmon. The permit would also allow the DOE to kill no more than four juvenile, naturally-produced PS chinook salmon, one juvenile, artificially-propagated PS chinook salmon, and one juvenile HCS chum salmon as an indirect result of being captured. Sampling activities will occur in the Nooksack/Samish River Basin.

The research will be conducted in various Puget Sound river systems throughout Washington state, hence it is not possible to determine the effects on a single breeding population in this ESU. However, NMFS roughly estimates eight million juvenile naturally-produced PS chinook salmon will outmigrate to the Puget Sound Basin in addition to 7,995,000 juvenile, artificially-propagated PS chinook salmon stock outmigrating to the project areas. If this outmigration is typical for future years, the annual loss of up to four juvenile, naturally-produced PS chinook salmon, one juvenile, artificially-propagated PS chinook salmon, and one HCS chum salmon associated with the DOE's research (indirect mortalities due to handling) will not have a measurable impact on the status of PS chinook and HCS chum salmon ESUs.

Cumulative Effects

Cumulative effects include the effects of future state, tribal, local or private actions not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to this consultation. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the Act.

State, tribal and local government actions will likely be in the form of legislation, administrative rules or policy initiatives. Government and private actions may include changes in land and water uses, including ownership and intensity, any of which could impact listed species or their habitat. Government actions are subject to political, legislative and fiscal uncertainties. These realities, added to geographic scope of the action area which encompasses numerous government entities exercising various authorities and the many private landholdings, make any analysis of cumulative effects difficult and frankly speculative. This section identifies representative actions that, based on currently available information, are reasonably certain to occur. It also identifies some goals, objectives and proposed plans by government entities. However, NMFS is unable to determine at this point in time whether any proposals will in fact result in specific actions.

Representative State Actions

The Washington state government is cooperating with other governments to increase environmental protection for listed ESUs, including better habitat restoration, hatchery and harvest reforms, and water resource management. The following list of major efforts—described in the Summer Chum Salmon Conservation Initiative (WDFW/PNPT 2000) and Steelhead Conservation Efforts (1996)— are directed at or contributing to the recovery of PS chinook and HCS chum salmon:

- Washington Wildlife and Recreation Program
- Wild Stock Restoration Initiative
- Joint Wild Salmonid Policy
- 1994 - Hood Canal Coordinating Council
- Governor's Salmon Recovery Office
- Conservation Commission
- Salmon Recovery Lead Entities
- Salmon Recovery Funding Board
- Forest and Fish Report
- Growth Management Act

There are other proposals, rules, policies, initiatives, and government processes that help conserve marine resources in the Puget Sound, improve the habitat of listed species, and assist in recovery planning that are too numerous to mention. As with the above state initiatives, these programs could benefit the listed species if implemented and sustained.

In the past, Washington state's economy was heavily dependent on natural resources, with intense resource extraction activity. Changes have occurred in the last decade and are likely to continue with less large scale resource extraction, more targeted extraction methods, and significant growth in other economic sectors. Growth in new businesses is creating urbanization pressures and has contributed to population growth and movement in the Puget Sound area, a trend likely to continue for the next few decades. Such trends will place greater demands in the action area for electricity, water and buildable land; will affect water quality directly and indirectly; and will increase the need for transportation, communication and other infrastructure development. These impacts will affect habitat features, such as water quality and quantity, which are important to the survival and recovery of the listed species. The overall effect is likely to be negative, unless carefully planned for and mitigated through the initiatives and measures described above.

Local Actions

Local governments will be faced with similar but more direct pressures from population pressures. There will be demands for intensified development in rural areas as well as increased demands for water, municipal infrastructure and other resources. The reaction of local governments to such pressures is difficult to assess at this time without certainty in policy and funding. In the past local governments in the action area generally accommodated additional growth in ways that adversely affected listed fish habitat allowing for development to destroy wetlands, habitat, etc.

Some local government programs, if submitted, may qualify for a limit under the NMFS' ESA section 4(d) rule which is designed to conserve listed species. Local governments also may participate in regional watershed health programs, although political will and funding will determine participation and therefore the effect of such actions on listed species. Overall, without comprehensive and cohesive beneficial programs and the sustained application of such programs, it is likely that local actions will have few measurable positive effects on listed species and their habitat, and may even contribute to further degradation.

Tribal Actions

Tribal governments participate in cooperative efforts involving watershed and basin planning designed to improve fish habitat and are expected to continue to do so. The results from changes in tribal forest and agriculture practices, in water resource allocations, and in changes to land uses are difficult to assess for the same reasons discussed under State and Local Actions. The earlier discussions related to growth impacts apply also to tribal government actions. Tribal governments will need to apply comprehensive and beneficial natural resource programs to areas under their jurisdiction to produce measurable positive effects for listed species and their habitat.

Private Actions

The effects of private actions are the most uncertain. Private landowners may convert current use of their lands, or they may intensify or diminish current uses. Individual landowners may voluntarily initiate actions to improve environmental conditions, or they may abandon or resist any improvement efforts. Their actions may be compelled by new laws, or may result from growth and economic pressures. Changes in ownership patterns will have unknown impacts.

Summary

Non-federal actions on listed species are likely to continue affecting listed species. The cumulative effects in the action area are difficult to analyze considering the geographic landscape of this opinion, the uncertainties associated with government and private actions, and the changing economies of the region. Whether these effects will increase or decrease is a matter of speculation; however, based on the trends identified in this section, the adverse cumulative effects are likely to increase. Although state, Tribal and local governments have developed plans and initiatives to benefit listed fish, they must be applied and sustained in a comprehensive way before NMFS can consider them "reasonably foreseeable" in its analysis of cumulative effects.

Integration and Synthesis of Effect

PS chinook salmon

The vast majority (more than 95%) of the juvenile PS chinook salmon that will be captured, handled, observed, etc., during the course of the proposed research (a total of 5,636 juvenile and 48 adult fish) are expected to survive with no long-term effects. Moreover, most capture, handling, and holding methods will be minimally intrusive and of short duration. Because so many of the captured fish are expected to survive the research actions and so few (a maximum of 0.04% of the total PS chinook salmon outmigration and 0.11% of the total PS chinook salmon escapement) will be affected in even the slightest way, it is likely that no adverse effects will result from these actions at either the population or the ESU level. Therefore, adverse effects must be expressed in terms of the individual fish that may be killed during the various permitted activities. The following table summarizes these effects for each permit.

Table 7. Maximum Annual Takes of Threatened Puget Sound Chinook Salmon

	Adult				Juveniles			
Permit			MORTALITY				MORTALITY	
Action	C,H,R	C,T/M,R	DIRECT	INDIRECT	C,H,R	C,T/M,R	DIRECT	INDIRECT
1140					336	5,000		419
1309							10	
1381					60			4
1386	48				240			5
Total	48				636	5,000	10	428

KEY: C,H,R = Capture, Handle, Release; C,T/M,R = Capture, Tag/Mark, Release

If the total amount of estimated lethal take for all research activities—438 juvenile PS chinook salmon—is expressed as a fraction of the 15,995,000 fish expected to reach Puget Sound, it represents a loss of 0.003% of the run. However, and for a number of reasons, that number is in actuality probably much smaller. First, as stated earlier in the Opinion, the anticipated outmigration of PS chinook salmon is some number larger than the 8,000,000 fish and the ESA-listed hatchery fish released exceed 7,000,000 fish. It is impossible to say how much bigger that number would be if we had figures for all of the spawning populations in the Puget Sound Basin, but it is certain that using the 15,995,000 figure to represent the entire PS chinook salmon outmigration is a very conservative estimate. Second, it is important to remember that every estimate of lethal take for the proposed studies has purposefully been inflated to account for potential accidental deaths, and it is therefore very likely that fewer than 438 juveniles will be killed by the research—possibly many fewer. Third, some of the studies will specifically affect PS chinook salmon in the smolt stage, but others will not. These latter studies are described as affecting “juveniles,” which means they may target PS chinook salmon yearlings, parr, or even fry: life stages represented by many more individuals than reach the smolt stage—perhaps as much as an order of magnitude more. Therefore the 0.003% figure was derived by (a) underestimating the actual number of outmigrating PS chinook salmon smolts, (b) overestimating the number of fish likely to be killed, and (c) treating each dead PS chinook salmon as a smolt when some of them clearly won’t be. Thus the actual number of PS chinook salmon the research is likely to kill is undoubtedly smaller than 0.003%—perhaps as little as half (or less) of that figure.

But even if the entire 0.003% of the juvenile PS chinook salmon population were killed, and they were *all* treated as smolts, it would be very difficult to translate that number into an actual effect on the species. Even if the subject were one adult killed out of a population of one thousand, it would be hard to resolve an adverse effect. And in this instance, that effect is even smaller because the loss of a smolt is not equivalent to the loss of an adult in terms of species survival and recovery. This is due to the fact that a great many smolts die before they can mature into adults. Nonetheless, regardless of its magnitude, that negative effect must be juxtaposed with the benefits to be derived from the research (see descriptions of the individual permits). In all, the fish will derive some benefit from every permit considered in this Opinion. The amount of benefit will vary, but in some cases it may be significant. Therefore, in deciding whether to issue the permits considered here, NMFS must compare the tangible benefits they will produce (some of which are potentially significant) with the negligible adverse effects they will cause. Moreover, NMFS must weigh similar factors (benefit versus adverse effect) when deciding whether the contemplated actions will appreciably reduce the likelihood of the PS chinook salmon’s survival and recovery—the critical determination in issuing any biological opinion.

<u>HCS chum salmon</u>

The vast majority (more than 95%) of the HCS chum salmon that will be captured, handled, observed, etc., during the course of the proposed research (a total of 21 juvenile and four adult fish) are expected to survive with no long-term effects. Moreover, most capture, handling, and holding methods will be minimally intrusive and of short duration. Because so many of the captured fish are expected to survive the research actions and so few (a maximum of 0.001% of the total HCS chum salmon outmigration and 0.04% of the adult escapement) will be affected in even the slightest way, it is likely that no adverse effects will result from these actions at either the population or the ESU level. Therefore, adverse effects must be expressed in terms of the individual fish that may be killed during the various permitted activities. The following table summarizes these effects for each permit.

Table 6. Maximum Annual Takes of Threatened HCS Chum Salmon

	Adult				Juveniles			
Permit			MORTALITY				MORTALITY	
Action	C,H,R	C,T/M,R	DIRECT	INDIRECT	C,H,R	C,T/M,R	DIRECT	INDIRECT
1386	4				20			1
Total	4				20			1

KEY: C,H,R = Capture, Handle, Release; C,T/M,R = Capture, Tag/Mark, Release

If the total amount of estimated lethal take for all research activities—one juvenile HCS chum salmon—is expressed as a fraction of the 1,444,000 fish expected to reach Puget Sound, it represents a loss of 0.0001% of the run. However, and for a number of reasons, that number is in actuality probably much smaller. First, as stated earlier in the Opinion, the anticipated outmigration of HCS chum salmon is some number larger than the 1,444,000 fish. It is impossible to say how much bigger that number would be if we had figures for all of the spawning populations in the Hood Canal Basin, but it is certain that using the 1,444,000 figure to represent the entire HCS chum salmon outmigration is a very conservative estimate. Second, it is important to remember the fact that every estimate of lethal take for the proposed studies has purposefully been inflated and it is therefore very likely that fewer than one juvenile will be killed by the research—possibly many fewer. Therefore the 0.0001% figure was derived by (a) underestimating the actual number of outmigrating HCS chum salmon juveniles, and (b) overestimating the number of fish likely to be killed. Thus the actual number of HCS chum salmon the research is likely to kill is undoubtedly smaller than 0.0001%—perhaps as little as half (or less) of that figure.

But even if the entire 0.0001% of the juvenile HCS chum salmon population were killed, it would be very difficult to translate that number into an actual effect on the species. Even if the subject were one adult killed out of a population of one thousand, it would be hard to resolve an adverse effect. And in this instance, that effect is even smaller because the loss of a juvenile is not equivalent to the loss of an adult in terms of species survival and recovery. This is due to the fact that a great many juveniles and subadults die before they can mature into adults. Nonetheless, regardless of its magnitude, that negative effect must be juxtaposed with the benefits to be derived from the research (see descriptions of the individual permits). In all, the fish will derive some benefit from every permit considered in this Opinion. The amount of benefit will vary, but in some cases it may be significant. Therefore, in deciding whether to issue the permits considered here, NMFS must compare the tangible benefits they will produce (some of which are potentially significant) with the negligible adverse effects they will cause. Moreover, NMFS must weigh similar factors (benefit versus adverse effect) when deciding whether the contemplated actions will appreciably reduce the likelihood of the HCS chum salmon's survival and recovery—the critical determination in issuing any biological opinion.

Conclusion

After reviewing the current status of the threatened PS chinook and HCS chum salmon ESUs, the environmental baseline for the action area, the effects of the proposed section 10(a)(1)(A) permit actions, and cumulative effects, it is NMFS' biological opinion that issuance of the proposed permits is not likely to jeopardize the continued existence of threatened PS chinook and HCS chum salmon, nor destroy nor adversely modify their habitat.

Coordination with the National Ocean Service

The activities contemplated in this Biological Opinion will not be conducted in or near a National Marine Sanctuary. Therefore, these activities will not have an adverse effect on any National Marine Sanctuary.

Reinitiation of Consultation

Consultation must be reinitiated if: The amount or extent of annual takes specified in the permits and this consultation is exceeded or is expected to be exceeded; new information reveals effects of the actions that may affect the ESA-listed species in a way not previously considered; a specific action is modified in a way that causes an effect on the ESA-listed species that was not previously considered; or a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16).

MAGNUSON-STEVENS ACT ESSENTIAL FISH HABITAT CONSULTATION

"Essential fish habitat" (EFH) is defined in section 3 of the Magnuson-Stevens Act (MSA) as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." NMFS interprets EFH to include aquatic areas and their associated physical, chemical and biological properties used by fish that are necessary to support a sustainable fishery and the contribution of the managed species to a healthy ecosystem.

The MSA and its implementing regulations at 50 CFR 600.920 require a Federal agency to consult with NMFS before it authorizes, funds or carries out any action that may adversely effect EFH. The purpose of consultation is to develop a conservation recommendation(s) that addresses all reasonably foreseeable adverse effects to EFH. Further, the action agency must provide a detailed, written response NMFS within 30 days after receiving an EFH conservation recommendation. The response must include measures proposed by the agency to avoid, minimize, mitigate, or offset the impact of the activity on EFH. If the response is inconsistent with NMFS' conservation recommendation the agency must explain its reasons for not following the recommendations.

The objective of this consultation is to determine whether the proposed actions, the funding and issuance of scientific research permits under section 10(a)(1)(A) of the ESA for activities within the state of Washington, is likely to adversely affect EFH. If the proposed actions are likely to adversely affect EFH, a conservation recommendation(s) will be provided.

Identification of Essential Fish Habitat

The Pacific Fishery Management Council (PFMC) is one of eight Regional Fishery Management Councils established under the Magnuson-Stevens Act. The PFMC develops and carries out fisheries management plans for Pacific coast groundfish, coastal pelagic species and salmon off the coasts of Washington, Oregon and California. Pursuant to the MSA, the PFMC has designated freshwater and marine EFH for chinook and chum salmon and for several other species (PFMC 1999). For purposes of this consultation, freshwater EFH for Pacific salmon in Washington includes all streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to Pacific salmon, except areas upstream of certain impassable dams (as identified by PFMC), and longstanding, naturally-impassible barriers (i.e., natural waterfalls in existence for several hundred years) (PFMC 1999). Marine EFH for Pacific salmon in Washington, Oregon and California includes all estuarine, nearshore and marine waters within the western boundary of the U.S. Exclusive Economic Zone (EEZ), 200 miles offshore.

Proposed Action and Action Area

For this EFH consultation the proposed actions and action area are as described in detail in the ESA consultation above. The actions are the funding and issuance of a number of scientific research permits pursuant to section 10(a)(1)(A) of the ESA. The proposed action area is the Puget Sound Basin, Washington. A more detailed description and identification of EFH for salmon is found in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999). Assessment of the impacts to these species' EFH from the above proposed action is based on this information.

Effects of the Proposed Action

Based on information submitted by the action agencies and permit applicants, as well as NMFS' analysis in the ESA consultation above, NMFS believes that the effects of this action on EFH are likely to be within the range of effects considered in the ESA portion of this consultation.

Conclusion

Using the best scientific information available and based on its ESA consultation above, as well as the foregoing EFH sections, NMFS has determined that the proposed actions are not likely to adversely affect EFH for Pacific salmon

EFH Conservation Recommendation

NMFS has no conservation recommendations to make in this instance.

Consultation Renewal

The action agencies must reinitiate EFH consultation if plans for these actions are substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for the EFH conservation recommendations (50 CFR Section 600.920(k)).

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